Claims

I claim as my invention:

1. A prosthesis, in the form of a rod with a length much greater than its diameter, that is surgically implanted and can be expanded in length without new surgery, in combination with a magnetic apparatus that is external to the patient's body and generates a magnetic field that interacts with the magnet in the said prosthesis comprising:

   a magnet in the said prosthesis;

   a mechanism that transforms the motion of the said magnet in the prosthesis, relative to other parts of the said prosthesis, into an expansion of the length of the said prosthesis;

   means to rotate the magnetic field that is generated by the said magnetic apparatus relative to the patient's body.

2. The combination defined in claim 1 wherein the said mechanism comprises at least one pair of mutually meshing male and female threads and wherein the said motion of the said magnet in the prosthesis is a rotation relative to other parts of the said prosthesis and causes an expansion of the said prosthesis.
3. The combination defined in claim 1 wherein the said magnet in the said prosthesis is a permanent magnet.
4. The combination defined in claim 1 wherein the said magnet in the said prosthesis is an electromagnet.

5. The combination defined in claim 1 wherein there is in the said prosthesis a ratchet mechanism that allows an expansion of the length of the said prosthesis, but prevents a reduction of the length.
6. The combination defined in claim 1 wherein the said magnetic apparatus is supported by rollers or by bearings that allow the rotation of the said magnetic apparatus around the patient's limb that contains the prosthesis.
7. The combination defined in claim 1 wherein the magnetic field of the said magnetic apparatus is produced by at least one electromagnet.
8. The combination defined in claim 1 wherein the magnetic field of the said magnetic apparatus is produced by at least one permanent magnet.
9. The combination defined in claim 7 wherein the electric power to the said electromagnets is supplied via slip rings and electric brushes from a stationary power supply.
10. The combination defined in claim 5 wherein the said ratchet mechanism contains an elastomer with flexible prongs that engage the teeth on the shaft of the said ratchet mechanism.
11. A magnetic apparatus external to a patient's limb and comprising at least four electromagnets, in combination with prostheses that use an internal magnet, the said magnetic apparatus generating magnetic fields interacting with the magnet in the prosthesis by means of current pulses that are short compared to the pauses between them.
12. The combination defined in claim 11 wherein the said current pulses are generated by discharges of capacitors.

13. The combination defined in claim 11 wherein electric switches control the length and timing of the said current pulses and, when needed, reverse the current direction in the said current pulses.

14. The combination defined in claim 1 wherein the said magnetic apparatus comprises at least one magnetic field sensor and readout for the observation by the physician of the position of the said magnet in the said prosthesis, obviating the need for multiple x-ray examinations.

15. The combination defined in claim 1 wherein a sling is provided that is exerting a controlled stretching force to the patient's limb that has the said prosthesis.

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